GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: February 22, 1979

Project Title: Student Science Training Program: Polymer, Fiber and Textile Science and Engineering

Project No: E-27-560

Project Director: Dr. John L. Lundberg

Sponsor: National Science Foundation

Agreement Period: From 2/15/79 Until 10/31/79 (Grant Period)

Type Agreement: Grant No. SPI-7827810

Amount: $29,320

Reports Required: Final Project Report

Sponsor Contact Person (s):

Technical Matters

(NSF Program Official)
Mary M. Kohlerman
Student Oriented Programs
Division of Scientific Personnel Improvement
National Science Foundation
Washington, D. C. 20550
202/282-7150

Contractual Matters
(thru OCA)

(NSF Grants Official)
Ms. Mary Frances O'Connell
Grants Specialist
MPE/BBS/SE Branch
Division of Grants and Contracts
National Science Foundation
Washington, D. C. 20550
202/632-2858

Defense Priority Rating: None

Assigned to: Textile Engineering (School/Laboratory)

COPIES TO:

- Project Director
- Division Chief (EES)
- School/Laboratory Director
- Dean/Director–EES
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- Project Code (GTRI)
- Other _____

CA-3 (3/76)

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

Date: May 2, 1980

Project Title: Student Science Training Program: Polymer, Fiber and Textile Science and Engineering

Project No: E-27-560

Project Director: Dr. J. L. Lundberg

Sponsor: National Science Foundation

Effective Termination Date: October 31, 1979

Clearance of Accounting Charges: October 31, 1979

Grant/Contract Closeout Actions Remaining:

_ Final Invoice and Closing Documents
X Final Fiscal [redacted] Accounting (FCTR)
_ Final Report of Inventions
_ Govt. Property Inventory & Related Certificate
_ Classified Material Certificate
_ Other _____

Assigned to: Textile Engineering (School/[redacted])

COPIES TO:

Project Director
Division Chief (EES)
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Accounting Office
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Library, Technical Reports Section
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Project File (OCA)
Project Code (GTRI)
Other C. E. Smith

CA–4 (1/79)

E-27-445
B 423

E-21-560

FINAL REPORT

1979 National Science Foundation Student Training Program
in
Polymer, Fiber & Textile Science & Engineering
at the
Georgia Institute of Technology
June 17 - August 3, 1979

- Abstract -

Fifty-six students from 43 high schools in nine states, Puerto Rico and Brazil worked on 57 different research projects with 47 research advisers from 15 schools and departments and the Engineering Experiment Station at Georgia Tech. Most projects were multidisciplinary; disciplines, major subjects and materials involved were engineering (26 projects), chemistry (16) including synthesis (6), physics (15), textiles (14), materials science and engineering (12), polymers (8), mechanics (8), computers and programming (7), the environment (6), metals (6), composite structures (5), energy (4), acoustics (4), architecture (3), psychology (2), and mathematics (1). Results ranged from superior to poor with good results in more than half of the projects; results will be published as parts of continued research.

Participants attended 43 seminars in which science, engineering, and mathematics were discussed and demonstrated without the usual separation into disciplines. Our macromolecular environment was emphasized with discussions of polymers, fibers, and textiles. Thirteen speakers from other schools at Georgia Tech or from off campus presented twelve colloquia. Six optional seminars on continuum mechanics and seven optional seminars on Newtonian mechanics, thermodynamics, and quantum mechanics were offered. All students were introduced to computing with four hours demonstration and hands-on experience. Nine two hour seminars on programming, computing and use of the Georgia Tech computer facilities were optional. All participants took part in additional seminars on English, counselling, and reports on their research. Three field trips, to an observatory and planetarium, to a nylon and polyester fiber plant and a nuclear and hydroelectric energy complex, and to botannical gardens and an experimental farm, demonstrated several applied sciences and engineerings at work. Seventeen group activities, including twelve off-campus outings and seven picnics or suppers were provided.

The students, 37 boys and 19 girls, 15 minority members, and 33 from schools with limited opportunity or encouragement in science, did well in their work, better than any group in the Georgia Tech SST programs to date except for the 1978 group. They benefitted from study of science, mathematics and engineering without separation into subjects or disciplines. Students were required to work on their own; most responded well. Most made good transitions from the limited choices of rigidly structured secondary schools to the diversity of multidisciplinary opportunities in a technical university.

Submitted by:

John L. Lundberg
NSF-SSTP Director
School of Textile Engineering
Georgia Institute of Technology

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

FINAL PROJECT REPORT
NSF FORM 98A

PLEASE READ INSTRUCTIONS ON REVERSE BEFORE COMPLETING

PART I–PROJECT IDENTIFICATION INFORMATION

1. Institution and Address	2. NSF Program	3. NSF Award Number
Georgia Institute of Technology 225 North Avenue, NW Atlanta, GA 30332	Student Science Training	SPI-7827810
	4. Award Period From 2/15/79 To 10/31/79	5. Cumulative Award Amount $29,320

6. Project Title

Student Science Training Program in Polymer, Fiber and Textile Science and Engineering.

PART II–SUMMARY OF COMPLETED PROJECT *(FOR PUBLIC USE)*

Fifty-six students from 43 high schools in nine states, Puerto Rico and Brazil worked on 57 different research projects with 47 research advisers from 15 schools and departments and the Engineering Experiment Station at Georgia Tech. Most projects were multidisciplinary; disciplines, major subjects and materials involved were engineering (26 projects), chemistry (16) including synthesis (6), physics (15), textiles (14), materials science and engineering (12), polymers (8), mechanics (8), computers and programming (7), the environment (6), metals (6), composite structures (5), energy (4), acoustics (4), architecture (3), psychology (2), and mathematics (1). Results ranged from superior to poor with good results in more than half of the projects; results will be published as parts of continued research.

Participants attended 43 seminars in which science, engineering, and mathematics were discussed and demonstrated without the usual separation into disciplines. Our macromolecular environment was emphasized with discussions of polymers, fibers, and textiles. Thirteen speakers from other schools at Georgia Tech or from off campus presented twelve colloquia. Six optional seminars on continuum mechanics and seven optional seminars on Newtonian mechanics, thermodynamics, and quantum mechanics were offered. All students were introduced to computing with four hours demonstration and hands-on experience. Nine two hour seminars on programming, computing and use of the Georgia Tech computer facilities were optional. All participants took part in additional seminars on English, counselling, and reports on their research. Three field trips, to an obsveratory and planetarium, to a nylon and polyester fiber plant and a nuclear and hydroelectric energy complex, and to botannical gardens and an experimental farm, demonstrated several applied sciences and engineerings at work. Seventeen group activities, including twelve off-campus outings and seven picnics or suppers were provided.

PART III–TECHNICAL INFORMATION *(FOR PROGRAM MANAGEMENT USES)*

1. ITEM *(Check appropriate blocks)*	NONE	ATTACHED	PREVIOUSLY FURNISHED	TO BE FURNISHED SEPARATELY TO PROGRAM	
				Check (✓)	Approx. Date
a. Abstracts of Theses	X				
b. Publication Citations	X				
c. Data on Scientific Collaborators	X				
d. Information on Inventions	X				
e. Technical Description of Project and Results		X			
f. Other *(specify)* Final Report		X			

2. Principal Investigator/Project Director Name *(Typed)*	3. Principal Investigator/Project Director Signature	4. Date
John L. Lundberg	John L. Lundberg	4/2/80

NSF Form 98A (5-78) Supersedes All Previous Editions

Form Approved OMB No. 99R0013

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Final Report: 1979 NSF-SSTP, Georgia Tech, June 17 - August 3, 1979

I. Preparation

A. Advertising

Mr. Craig Anderson of the School of Textile Engineering prepared a brochure (Appendix I) for distribution before awards of grants were announced. These were distributed to all principals, counselors, and science and math teachers in public schools and many private and parochial schools in Georgia. Distributions were made by direct mail to the schools, through science coordinators in the larger systems and to teachers at their homes through listings by the Georgia Education Association and the Science Teachers Association. In spite of double coverage to most teachers and schools and triple coverage in the larger school districts for six years many teachers remain unaware of our program. In principle, all of these schools and teachers received the listing of all SST programs distributed by the Foundation.

Mr. Dallas Stewart, Science Coordinator, Education Department of the State of Georgia, and Mr. Lonnie Love, Assistant Coordinator, have been most helpful in 1973-79 in aiding us in contacting teachers, counselors, principals and school administrators. Thanks to their efforts we have been in contact with and participated in science programs of the regional resource centers in Georgia, and in the Governor's Honors Program for high school students.

We advertise our program at science fairs, group meetings of students and/or teachers, and in our visits to high schools and talks for high school science classes. Mr. Craig Anderson, recruiter and adviser for incoming students for Georgia Tech's School of Textile Engineering publicized our program in his visits to high schools in Georgia. Members of the faculty of the School of Textile Engineering have participated in regional and the state science fairs in recent years; at these our program has been announced.

Our best advertising is by students who have been in the program and by teachers whose students have participated in our program. In the last four years teachers in the Atlanta public schools have encouraged their students to participate. Mrs. Lucy Smith, Science Coordinator for the Atlanta School system, and her predecessor, Miss Kathryn Hertzka, have helped our faculty to become acquainted with teachers and students in Atlanta, this by including faculty members in science programs and the Atlanta Science Congress. From 1976-1979, this Atlanta science fair has met in the School of Textile Engineering Building and other buildings on campus. The hosts were Georgia Tech and the campus chapter of Sigma Xi. The Atlanta Science Congress will be at Georgia Tech again in March, 1980. This is good advertising for our summer program.

B. Selecting Students

Two hundred plus students inquired about our SST program. Eighty seven (87) students submitted applications. We accepted sixty five (65) of these as participants and eight (8) as alternates whom we would welcome into the program.

In 1979 as in previous years, students selected themselves for our program. Only those who are seriously interested bother with the long application forms and short essay. Most of the students who apply have sufficient desire and drive to succeed in our SST program. The same is true of applicants for admission to Georgia Tech. Only seriously interested, committed students come here; easier schools are accessible for those who just want to go to college. This reputation of Georgia Tech "rubs off" on our SST program.

Each year we learn a little more about selecting participants. We try to select on the following bases (in descending order of importance): 1. personal interviews with applicants, 2. telephone conversations with applicants, 3. statements in 300 or fewer words why the applicants wish to participate in the program, 4. face to face and telephone conversations with teachers, 5. teachers written recommendations, 6. class rank, 7. grades in high school courses, and 8. scores on standardized examinations.

Mr. Craig Anderson, counselor for incoming students in the School of Textile Engineering, and the program director interviewed about one third of the applicants and talked to the others by telephone. We accepted a few students who were not among the highest on the basis of test scores. For these students we found some correlation among the quality of students' written statements, teachers' recommendations, class rank, grades in courses, and scores on standardized examinations. Because of our interview of all applicants from Atlanta in 1975 and many applicants for our 1976-1979 programs and careful consideration of grade, class rank and PSAT scores and our experience with students from less than advantaged schools, we can estimate which of the low score students are likely to be able to participate successfully in our SST program.

Eight (8) students whom we accepted as participants and who did not participate in our SST program spent this part of the summer as follows:

Three (3) students attended another SST program (at the University of Southern California, the University of Georgia and the Louisiana State University).

Two (2) students probably attended other SST programs.

One (1) student participated in another summer program (the Governor's Honors Program in Georgia).

One (1) student attended a junior college during summer quarter.

Two (2) students did not respond to queries about their summer acitivites.

C. Soliciting Funds

We asked textile, fiber, carpet, and chemical manufacaturers for financial help with the program. $5500 was contributed by five corporations. Our record on NSF grants, private support and numbers of contributors to date is as follows:

Year	NSF Grant	Private Gifts	Participants
1973	$15,776	$1,750	31
1974	11,430	7,200	31
1975	21,170	1,500	37
1976	20,660	5,700	58
1977	22,280	4,700	44
1978	24,030	3,500	49
1979	29,320	5,500	56

II. Participants

A. Profile

We compare our SSTP participants to our undergraduate students at Georgia Tech. About eighty-five percent of these are engineering, science and architecture majors with the majority in engineering. The average SAT score is about 1200. Compared to these undergraduates, we rate as good (with grade 2.0 or C) those SSTP applicants whom we would welcome as undergraduates. With this frame of reference, our estimates of the par ticipants and other applicants before the start of the program is given in Table I.

Table I

Estimated Potential for Research Performance of Participants and Other Applicants to Georgia Tech's 1979 SST Program

	Gifted (4.0-A)	Very Good (3.0-B)	Good (2.0-C)	Fair (1.0-D)	Poor (0.0-F)	Totals Number	Avg. Gr.
Participants	4	23	22	7	0	56	2.43
Limited Opportunity	0	8	19	6	0	33	2.06
Accepted applicants who did not participate	0	6	3	0	0	9	2.67
Limited Opportunity	0	3	2	0	0	5	2.60
Alternates	0	0	2	5	1	8	1.18
Limited Opportunity	0	0	0	4	1	5	0.80

At least thirty-three (33) of the fifty six (56) participants have had limited opportunity to study and work in science. The fraction of participants with limited opportunity was higher in 1979 than in previous years, probably due to our more rigorous estimates of qualities of high schools. Further description of the group is given by the following data:

Number "first" in their high school classes	10
Number of girls	19
Number of boys	37
Number of members of "minority groups"	15
Number of inner city	11
Number from smaller cities	8
Number from suburbs	19
Number from small towns and rural areas	18
Number from Georgia	35
Number from other states	19
(One participant came from Puerto Rico & one from Brazil.)	
Number with good to superior over-all opportunity	23
Number whose opportunity could be improved	33
Number who lived on campus	50
Number of commuters	6

In 1979, we had several students who were "first" in their respective classes. The 1979 group was more able than any previous groups except for 1978. We had a good mixture of students with a wide variety of interests, backgrounds, preparation and developed ability. This diversity is necessary for and conducive to learning. The participants learned at least as much from each other and Tech students as they did from faculty and staff. By interacting with peers they sharpened and developed interests and abilities. The 1979 group developed good comradery.

B. Participants' Name, Present Addresses, High Schools, Research Projects, and Advisers.

NAME & ADDRESS	SCHOOL & RESEARCH PROJECT
1. Ruth Shelton Alexander Caixa Postal 629 Fortaleza, Ceara 60,000 Brazil, S.A. After 8/3/79 Route no. 1 Cornelia, GA 30531	Fortaleza Academy Fortaleza, Ceara, Brazil "Construction of an Oscilloscope" J. L. Lundberg, Textile Engineering
2. Willie James Alexander Route 3, Box 42 Dawson, Georgia 31742 (912) 995-3867	Terrell County High School Dawson Georgia "Making Wall Board from Nutshells" - E.M. Hartley, Chemical Engineering
3. Catherine Marie Algeo 220 Cedar Creek Drive Athens, GA 30605 (404) 549-2229	Cedar Shoals High School Athens, Georgia "Further Development of the Question Answering System (QAS): Model Solving with Simultaneous Equations" - M. Konopasek Textile Engineering
4. Michael Jon Balles 3715 Gladstone Drive Virginia Beach, Virginia 23452 (804) 486-5373	Floyd E. Kellam High School Virginia Beach, VA "Synthesis of 4' Vinyl Benzene 15-Crown-5 Ether" - R. Robertson & F. L. Cook, Textile Engineering
5. Alexander Rollin Bapty 3320 SW 40th Avenue Hollywood, Florida 33023 (305) 983-5255	Nova High School Ft. Lauderdale, Florida "Detecting Fractures in Metals and Composites by Use of Acoustic Emission" - S.V. Hanagud, Aerospace Engineering
6. Ezekiel John Bridges P. O. Box 162 Moultrie, Georgia 31768 (912) 985-8739	Colquitt County High School Moultrie, GA 1. "Resolutions of Different Films in Neutron Radiography" - M.V. Davis & W. Downs, Nuclear Engineering 2. "Kirlian Photography" J. L. Lundberg, Textile Engineering

7. David Lane Bryant
2044 Pinecrest Drive
College Park, GA 30337
(404) 766-9722

Woodward Academy
College Park, GA

"Construction and Testing of Speaker Enclosures" - W.M. Leach Electrical Engineering

8. John Charles Buckley III
3780 Summer Place Ct.
Virginia Beach, VA 23456
(804) 463-0303

Floyd E. Kellam High School
Virginia Beach, Virginia

"Identifying Unknown Bacteria" - W. G. Davis, Biology

9. David Lee Citron
2749 No. 2 Briarcliff Rd.
Atlanta, GA 30329
(404) 325-9306

Briarcliff High School
Atlanta, Georgia

"Design of an Energy Efficient House" - J. J. Lundberg, Textile Engineering

10. Donald McClure Corbett III
1572 Withmere Way
Dunwoody, GA 30338
(404) 393-1864

Dunwoody High School
Dunwoody, GA

1) "Construction and Testing of Speaker Enclosures" and (2) "Construction of an Amplifier"- W.M. Leach & Schuyler Grace, Electrical Engineering

11. Dejuaii Ruth Craig
703 Mayland Avenue, S.W.
Atlanta, GA 30310
(404) 758-6077

Frederick Douglass High School
Atlanta, GA

"Electron Microscopic Studies of Metals" - S. Chakrabortty, Metallurgy Group, Chem. Engrg.

12. Geoffrey William Cundiff
1750 Tolleson Court
Dunwoody, GA 30338
(404) 394-7827

Dunwoody High School
Dunwoody, GA

1) "Studies of Glass Fiber-Resin Composites" - C. Anderson, Text. Engrg.
2) "Design of a Zero Energy House" - J.L. Lundberg, Textile Engineering

13. Timothy Bernard Daniels
59 Rogers Street, S.E.
Atlanta, Georgia 30317
(404) 373-8997

J. C. Murphy High School
Atlanta, GA

"Treatment and Disposal of Waste Water Sludges" - F.M. Saunders & M. Sezgin, Civil Engineering

14. Joseph Abdur-Rahim Dudar
1802 Vinson Highway
Milledgeville, GA 31061
(912) 452-4850

Baldwin County High School
Milledgeville, GA

"Heuristic Programming as Applied to the Problem of Untying Knots" - M. Konopasek, Textile Engineering

15. Bradley Thomas Elliott
5708 Braddock Court
Dunwoody, GA 30338
(404) 394-0924

Dunwoody High School
Dunwoody, GA

"Synthesis of New Organometallic Iminium Compounds" - E.K. Barefield, A.M. Carrier & D.A. Krost, Chemistry

16. David Ellis
Route 2
Donalsonville, GA 31745
(912) 861-3390

Seminole County High School
Donalsonville, GA

"Studies of the Use of Gamma Radiation to Decompose Organic Material in Water Purification" -G.G. Eichholz & A. Lavassani - Danai, Nuclear Engrg.

17. Tracy Joe Ellis
100 Pirkle Road
Griffin, GA 30223
(404) 227-2420

Griffin High School
Griffin, GA

"Soil Compaction and Load Bearing with Fabric Reinforcement" - Q.L. Robnett, Civil Engineering

18. David Alan Ferguson
232 Van Horn Road
Milton, Florida 32570
(904) 623-8052

Pace High School
Pace, Florida

"Computer Programs for Untying Knots" - M. Konopasek, Textile Engineering

19. Daisy Layson Fernandez
Route 1, Box 168
West Point, GA 31833
(404) 645-1856

West Point High School
West Point, GA

"Studies of Removal of Dye Wastes from Water" - W.C. Tincher, Textile Engrg.

20. Michael Terence Fitzpatrick
5725 Belleau Drive
Montgomery, Alabama 36117
(205) 277-8817

Robert E. Lee High School
Montgomery, Alabama

"Studies of Polymerization of Acrylonitrile using 18-Crown-6 Ether to Enhance Yields and Molecular Weights" - F.L. Cook & R. Robertson, Textile Engineering

21. Edward Paul Flinchem
9232 SE 46th Street
Mercer Island, Washington 98040
(206) 232-6791

Mercer Island High School
Mercer Island, Washington

"Studies of the Mathematical Characterization and Manipulation of Knots" - M. Konopasek, Textile Engineering

22. Robert Gustave Gabel
923 Mercedes Street
Albany, Georgia 31705
(912) 436-9615

Dougherty County High School
Albany, Georgia

"Studies of the Effects of Water and Dye Carriers on the Structure of Polyester" - K. Ko and J. L. Lundberg, Textile Engineering

23. Greg Steven Grabowski
295 Saddle Horn Circle
Roswell, GA 30075
(404) 992-9539

Roswell High School
Roswell, GA

"Synthesis of Adrenalin with DBH" -
Heath Herman, Chemistry

24. Carol Ann Griffin
Route 3, Box 56B
Waynesboro, GA 30830
(404) 554-5300

Waynesboro High School
Waynesboro, GA

"The Effects of Heat Setting on Properties of Polyester, Spun Yarn"-
W. C. Carter, Textile Engineering

25. Sherry Lynn Guice
502 West Wiley
Donalsonville, GA 31745
(912) 524-2734

Seminole County High School
Donalsonville, GA

1. "Assay of Dopamine β-Hydroxylase"
Heath Herman, Chemistry
2. "Effect of pH on Colors of Dyes"
W. C. Carter, Textile Engrg.

26. Randy Harrell
Route 2, Old Adel Road
Moultrie, GA 31768
(912) 985-9435

Colquitt County High School
Moultrie, GA

"A Comparison of Papers Made from Wood Pulp and Pine-Straw"-E.M. Hartley, Chemistry Engineering, & J.L. Lundberg Textile Engineering

27. John Edward Hilliard
Route 1, Box 11
Camilla, GA 31730
(912) 336-8562

Westwood Schools
Camilla, GA

"Using Alcohol as a Fuel in Diesel Engines" - W.D. Freeston
Textile Engineering

28. Howard Jay Ilvicky
793 Allwyn Street
Baldwin, NY 11510
(516) 223-4006

Baldwin Senior High School
Baldwin, NY

"Synthesis and Characterization of 4' Vinylbenzo-18-Crown-6 Ether",
F. L. Cook and R. Robertson,
Textile Engineering

29. Pamela Annette Jones
510 Chilowie Road
Columbia, SC 29209
(803) 783-1264

Lower Richland High School
Hopkins, SC

"Studies of Separations by Liquid Chromatography" -L.T. Gelbaum,
S. Bonetti & M. Witcher - Chemistry

30. Keith Walter Koenig
714 South Cypress Avenue
Marshfield, Wisconsin 54449
(715) 384-5377

Columbus High School
Marshfield, Wisconsin

"Studies of the Viscoelastic Behavior of Polyphosphazene Rubbers" - H. Y-L. Chen & J. Lee, ESM, & J. L. Lundberg,
Textile Engineering

31. George Scott Krasle
3861 Locklear Way
Doraville, GA 30360
(404) 448-1042

Westminster Schools
Atlanta, GA

"Design and Construction of a Programmable Sound Synthesizer" - J. Hamblen & C. O. Alford, Electrical Engineering

32. Judith Ann Lewis
Route 4
Moultrie, GA 31768
(912) 941-5620

Colquitt County High School
Moultrie, GA

"Studies of the Acceptability of Colors" - W.C. Tincher, Textile Engineering

33. Turner Lewis, III
13535 Charwell Crossing
Houston, Texas 77069
(713) 440-1173

Cypress Creek Senior High School
Houston, Texas

"Studies of Kirlian Photography" J. L. Lundberg, Textile Engineering

34. Susan Ruth Luhrman
8 Runnymede Road
Griffin, GA 30223
(404) 228-8907

Griffin High School
Griffin, GA

"Separation of Photographs from Multiply Exposed Films" -W.T. Rhodes, & S.J. Henriksen, Elect. Engrg.

35. Thomas Edward Manley
1715 Briarcliff Rd.
Milledgeville, GA 31061
(912) 452-7546

Baldwin County High School
Milledgeville, GA

"Construction and Testing of Speaker Enclosures" - W.T. Leach Electrical Engineering

36. Francisco Martorell
XX-4 14 St.
Caparra Gardens
Bayamon, Puerto Rico 00619
(809) 786-8712

Colegio San Ignacio de Loyola
Rio Piedras, Puerto Rico

"Design of an Energy Self Sufficient House" - J.L. Lundberg Textile Engineering

37. Neil James Mavis
244 North Warren Street
Monticello, GA 31064
(404) 468-8773

Jasper County Comprehensive High School

1) "Study of Acoustic Emission in Metals" - S.V. Hanagud, & M. Chouinard Aerospace Engrg. 2)"Design & Construction of an Amplifier" - W.T. Leach Electrical Engineering

38. Gerald Garris McGlamery, Jr.
214 Robin Hood Drive
Florence, Alabama 35360
(205) 766-6879

Henry A. Bradshaw High School
Florence Alabama

"An Analysis of the Use of Knitted Fabrics in Filter Bags for Control of Air Pollution" - L.H. Olson, Textile Engineering

39. Gilbert Cecil Milner
413 N.W. 34th Drive
Gainsville, Florida 32607
(907) 372-0248

P. K. Yonge Laboratory School
University of Florida
Gainesville, Florida

"A Study of the Theory of Knots" - M. Konopasek, Textile Engineering

40. Robert Bradley Mock
Route 5, Tallokas Road
Moultrie, GA 31768
(912) 985-9440

Colquitt County High School
Moultrie, GA 31768

"Construction of a Home-Made Electron Microscope" - S. Chakrabortty, Metallurgy Group, Chemistry Engineering

41. Anthony Scott Newel
6391 Lakeview Drive
Buford, GA 30518
(404) 945-2598

North Gwinnett High School
Suwanee, GA

"Question Answering System (QAS): Developing a Program to Store & Retrieve Models" - M. Konopasek, Textile Engineering

42. Janis Chatman Parket
698 Caron Circle, N.W.
Atlanta, GA 30318
(404) 794-8540

Frederick Douglass High School
Atlanta, GA

"Viscoelastic Behavior of Elastin" - J.L. Lundberg, Textile Engineering
H.Y.-L Chen, ESM

43. Phillip Gregory Payne
4126 Cornell Blvd.
Atlanta, GA 30331
(404) 691-6248

Northside High School
Atlanta, GA

1) "Construction of an Operational Amplifier" 2) "Light Scattering by Fibers" - K. K-Y. Ko & J.L. Lundberg Textile Engineering

44. Marsha Dawn Poole
Box 132
Marshalville, GA 31057
(912) 967-2303

Macon County High School
Montezuma, GA

"Synthesis of Compounds Containing Transition Elements" - H.M. Neuman, Chemistry

45. Margaret Rose Roher
819 West Eight Street
Tifton, GA 31794
(912) 386-2069

Tift County High School
Tifton, GA

"Studies of Taste Aversion in Rats" - M.J. Marr, Psychology

46. Brad David Simons
62 Ann Drive, South
Freeport, NY 11520
(516) 623-8965

Freeport High School
Freeport, NY

"A Study of Reactions of Reactive Dyes with Alcohols" - W.C. Carter, Textile Engineering

47. Lisa Patrice Turner
904 East Godbold Street
Marion, SC 29751
(803) 423-3373

Marion High School
Marion, SC

"A Study of the Effect of Interfiber Bonding in Fabrics and Its Effect on Fiber Properties" - W.C. Carter, Textile Engineering

48. Mary Elizabeth Ward
2108 Pisgah Road
North Augusta, SC 29841
(803) 279-3132

North Augusta Senior High School
North August, SC

"Synthesis of Compounds Containing Transition Elements" - H.M. Neuman, Chemistry

49. Elaine Allison Webb
1692 Camelot Circle
Tucker, GA 30084
(404) 938-4928

Shamrock High School
Decatur, GA

"Studies of the Use of Gamma Radiation to Decompose Organic Material in Water Purification" - G.G. Eicholz, G.W. Poston, A. Vavassani-Danai & L. Quintessa, Nuclear Engrg. & J. M. Smith, Radiation Safety

50. Eileen Edith Webb
1692 Camelot Circle
Tucker, GA 30084
(404) 938-4928

Shamrock High School
Decatur, GA

"A Study of Fermentation of Kudzu to Produce Ethanol" - R.S. Roberts & D.L. Johnson, Chem. Engrg.

51. Tina Weiss
4533 NW Third Street
Plantation, Florida
(305) 581-5667

Nova High School
Fort Lauderdale, Florida

"A Study of the Effects of Ultrasonic Vibration on the Stress-Strain Behavior of Aluminum" - B.R. Livesay, Engrg, Expt. Station

52. Julius Bernard Wilson
P. O. Box 467
Dawson, GA 31742
(912) 995-5350

Terrell County High School
Dawson, GA

"A Study of Paper Made from Corn Cobs" - E.M. Hartley Chemical Engineering

53. Michael Darryl Wilson
1820 King Alfred Dr., S.W.
Atlanta, GA 30331
(404) 394-0116

Southwest High School
Atlanta, GA

"A Study of Properties of Alumnum" - S. Chakrabortty, Metallurgy Group, Chemical Engineering

54. Helen Lorraine Wingate
3707 San Mateo
El Paso, Texas 79902
(912) 544-9830

El Paso High School
El Paso, Texas

"A Study of the Effects of Solar Radiation on the Viscoelastic Response of Elastin" - J.L. Lundberg Textile Engrg. & H.Y-L. Chen. ESM

55. Seokgeum Yun
5359 Taney Avenue, No. 201
Alexandria, VA 22304
(703) 370-4080

J. C. Williams High School
Alexandria, VA

"Structural Design of a Bridge" - L.F. Kahn, Civil Engineering

56. Kathy Lynn Yuracko
10 Walworth Avenue
Scarsdale, NY 10583
(912) 472-6336

Scarsdale High School
Scarsdale, NY

"Studies of Neutron Scattering" M.V. Davis, Nuclear Engineering

III. The Program

A. Research

The purpose of the program was to introduce students to research in engineering and science and to help them carry on research of some value. Fifty-six (56) student participants worked on fifty-seven (57) different research problems. Forty seven (47) research advisers from ten schools at Georgia Tech, Chemical, Civil, Electrical, Nuclear and Textile Engineering, Engineering Science and Mechanics, and Biology, Chemistry, Psychology, from the Metallurgy Faculty and the Health Physics Group, and from the Engineering Experiment Station helped the students with their research.

The diversity of research projects was as great or greater than in past years. Most projects were multidisciplinary. A breakdown of principal disciplines, major subjects, and materials involved is as follows:

Disciplines Involved	Number of Projects	Major Subjects and Materials Involved	Number of Projects
Engineering	26	The environment	6
Chemistry	16	Chemical synthesis	6
Physics	15	Metals	6
Textiles	14	Composite structures	5
Materials science and engineering	12	Energy	4
Polymers	8	Acoustics	4
Mechanics	8	Architecture	3
Computers and programming	7	Psychology	2
		Mathematics	1

The emphasis again this year on engineering is gratifying. High School students are more familiar with life science and chemistry than with

engineering. Therefore, they tend to select projects in these more familiar disciplines. High School students usually study biology first, chemistry second, and physics last, often in their senior years after participating in an SST program. Nine (9) students suggested their own research problems; fortunately we could find research advisers for them.

We want as great diversity as is possible in research problems among the students. They learn more from each other than from faculty. If the range of research subjects is great, the participants teach each other a wide range of subjects. Some exposure to a wide range of science and engineering is essential if students are to become interested in the fascinating and vital but less known areas of science and engineering. Lack of exposure to diversity coupled with too early specialization prevents young scientists and engineers from contributing to these fertile areas of need in science and engineering. We cannot afford to let the unpopular areas languish; often these are the areas of likely breakthrough. The well known and spotlighted areas of science and engineering tend to be overworked. Exposure to diversity should begin early.

Fair to good results were obtained in many of the research projects. Results will be published in years to come as continuing work is completed. At least five (5) of the participants are continuing to work on their research projects; three (3) have entered the Westinghouse Science Talent Search.

We put the students on their own as far as tending to their research. Of course, we encourage them and help them, but we "don't lead them by the hand". Some students don't accomplish as much as they should, but almost all who aren't as diligent as they should be learn from this mistake.

A few of the participants in the program were over achievers or superior achievers who were tired by constant extra effort and rested on their laurels in the program. Most of these did good work but not as much or as good as they

could have with maximum effort. In our program, participants make part of that change from structured programs, dependence upon close supervision and being pushed, and home to diversity of opportunity, independence and need for self-motivation, and living in a university; most respond and perform well. The names of students, research problems and research advisers are given on pages 9 through 16.

Research advisers for student participants were as follows:

Name	Degree	Position	School or Org.	Specialty
M. Chouinard	B.S. (AE)	Grad. Res. Asst.	Aerospace Engrg.	Acoustics
S.V. Hanagud	PhD (AE)	Professor	Aerospace Engrg.	Acoustics
* W.G. Davis	-	Student (senior)	Biology	Microbiology
L.F. Kahn	PhD (CE)	Asst. Professor	Civil Engineering	Structures
Q.L. Robnett	PhD (CE)	Assoc. Professor	Civil Engineering	Soils & Foundation
F.M. Saunders	PhD (CE)	Asst. Professor	Civil Engineering	Sanitation
M. Sezgin	B.S. (CE)	Grad. Res. Asst.	Civil Engineering	Sanitation
E.M. Hartley	PhD (Ch.E)	Assoc. Professor	Chemical Engrg.	Paper Processes
D.L. Johnson			Chemical Engrg.	Chem. Processes
R.S. Roberts	PhD (Ch.E)	Asst. Professor	Chemical Engrg.	Chem. Processes
E.K. Barefield	PhD (Chem)	Assoc. Professor	Chemistry	Synthesis
Sandra J. Bonetti	B.S. (Chem)	Grad. Res. Asst.	Chemistry	Organic Chemistry
A.M. Carrier	B.S. (Chem)	Grad. Res. Asst.	Chemistry	Synthesis
L.T. Gelbaun	PhD (Chem)	Res. Scientist	Chemistry	Organic Chemistry
Heath Herman	PhD (Chem)	Res. Associate	Chemistry	Biochemistry
D.A. Krost	B.S. (Chem)	Grad. Res. Asst.	Chemistry	Synthesis
H.M. Neumann	PhD (Chem)	Professor	Chemistry	Inorganic Chemistry
M.D. Witcher	B.S. (Chem)	Grad. Res. Asst.	Chemistry	Organic Chemistry
C.O. Alford	PhD (EE)	Regents Professor	Electrical Engrg.	
* Schuyler Grace	-	Student (sophomore)	Electrical Engrg.	Amplifiers
J. Hamblen	B.S. (EE)	Grad. Res. Asst.	Electrical Engrg.	
S.J. Henricksen			Electrical Engrg.	Information Storage
W.M. Leach	PhD (EE)	Assoc. Professor	Electrical Engrg.	Acoustics
W.T. Rhodes	PhD (EE)	Assoc. Professor	Electrical Engrg.	Information Storage
J.W. Larson	-	Student (senior)	Eng.Expt.Sta. & Physics	Expt. Chem. Physics
B.R. Livesay	PhD (Met)	Sr. Res. Scientist	Eng.Expt. Station	Metals Physics
H.Y-L. Chen	PhD (Mech)	Asst. Professor	Eng. Sci. & Mech.	Viscoelasticity
John Lee	B.S. (EE)	Grad. Res. Asst.	Eng. Sci. & Mech.	Digital Systems
J.M. Smith		Safety Engineer	Radiation Safety	Health Physics
S. Chakrabortty	PhD (Met)	Res. Scientist	Metallurgy	Electron Microscopy
M.V. Davis	PhD (Phys)	Professor, Dir.	Nuclear Res. Ctr.	Reactor Operation
G.G. Eichholz	PhD (Phys)	Regents Professor	Nuclear Engineering	
A.A. Larassani-Dana		Grad. Res. Asst.		Health Physics
J.W. Poston	PhD	Assoc. Professor		
Laura Quintana	B.S.	Grad. Res. Asst.	Nuclear Engineering	Health Physics
M.J. Marr	PhD (Psyc)	Assoc. Professor	Psychology	Animal Behavior
Michael Matheny	B.S.	Grad. Res. Asst.	Nuclear Engineering	Nuclear Engineering

Name	Degree	Position	School or Org.	Specialty
W.C. Carter	PhD (Chem)	Professor	Textile Engrg.	Polymer & Textile Chemistry
F.L. Cook	PhD (Chem)	Asst. Professor	Textile Engrg.	Organic & Textile Chemistry
W.D. Freeston	PhD (ME)	Prof. & Director	Textile Engrg.	Mechanical & Text. Engineering
K. K-Y. Ko	M.S. (Chem)	Grad. Res. Asst.	Textile Engrg.	Polymer & Physical Chemistry
Milos Konopasek	PhD (Text Phys)	Assoc. Professor	Textile Engrg.	Mechanics & Computers
J.L. Lundberg	PhD (Chem)	Professor	Textile Engrg.	Polymer & Physical Chemistry
L.H. Olson	PhD (Phys)	Assoc. Professor	Textile Engrg.	Fiber & Textile Phys.
J.R. Robertson, Jr.	M.S. (Text Chem)	Grad. Res. Asst.	Textile Engrg.	Textile & Organic Chemistry
W.C. Tincher	PhD (Chem)	Professor	Textile Engrg.	Polymer & Textile Chemistry

*Student participants in Georgia Tech's SST Program in past years.

Of this group of forty six (46) research advisers, nine (9) are senior faculty members (professors), fourteen (14) are assistant or associate professors, five (5) are senior scientists or research engineers, fifteen (15) are graduate research assistants, and three are undergraduate students two of whom participated in Georgia Tech's SST programs in past years. All members of the academic community should work with the participants in our SST program; each has special talents and advantages of experience, perspective, credibility, empathy, enthusiasm, communication, etc., which must be used. Research advisers in our 1979 program ranged in age from nineteen (19) to about sixty (60). Nine (9) natives of Asia and Europe are included along with two (2) women.

We believe that involvement of senior faculty is essential to the success of our SST program. Without Professors Carter and Tincher of the School of Textile Engineering, the program could not function. These senior faculty members serve as research advisers, seminar and discussion leaders. tutors counselors, chaueffeurs, and recreation leaders. Professor Monte Davis,

Director of the Nuclear Research Center, Dr. G. G. Eichholz, Regents Professor of Nuclear Engineering and Professor Henry Neumann of the School of Chemistry have provided some of the most interesting and rewarding research opportunities for our participants. Each of these faculty members has participated in our SST program for two or more years. Students are sensitive enough to determine quickly the degree of interest in and commitment to teaching of faculty members. Because senior faculty members show that they care for students and participate in the SST program, student participants return to Georgia Tech as undergraduates.

Dr. B. R. Livesay of the Engineering Station has served as research adviser for no fewer than thirteen participants in Georgia Tech's SST programs in the last seven (7) years. His contributions in micromechanics of fibers and fiber assemblies including systems of biological interest and in magnetic and mechanical properties of metals and metal hydrides have increased the scope of and interest in our SST programs. Professor S. V. Hanagud of the School of Aerospace Engineering opened his laboratory in acoustics and materials research to our students.

Professors Fred Cook, Milos Konopasek, and Howard Olson of the School of Textile Engineering have served in every possible capacity in making Georgia Tech's SST programs successful. These men have been involved in the SST programs for four to seven years. The SST programs would have been much the poorer without Professors Olson's contributions in textile structures and mechanics; Professor Cook's discussions and projects in organic, polymer, and textile chemistry; and Professor Konopasek's work with students in computing, textile engineering, and applied mathematics, mechanics, and geometry problems.

Professor William Rhodes of the School of Electrical Engineering has served as a research adviser for four years. He has welcomed students into

his busy and productive laboratory in information storage and has helped them to complete significant research projects. Professor Sheldon May and Dr. Heath Herman have welcomed participants to their biochemistry laboratory for three years. Professor Hyland Chen of the School of Engineering Science and Mechanics has served as research adviser to several SSTP participants in the last four years. He has interested several able students in mechanics and bioengineering.

Particularly effective helpers in research were the two undergraduate students also were participants in past SST programs at Tech. These are Gordon Davis (for the second year) and Schuyler Grace.

At least eleven (11) of the 1979 SSTP participants are continuing to work on their research problems. These are Ruth Alexander (Fortzleza, Brazil), Willie Alexander (Dawson, GA), Catherine Algeo (Athens, GA), Alexander Bapty (Hollywood, FL), Randy Harrell (Moultrie, GA), George Krasle (Doraville, GA), Gerald McGlamery, Jr. (Florence, AL), Robert B. Mock (Moultrie, GA), James Parker (Atlanta, GA), Elaine Webb (Tucker, GA) and Eileen Webb (Tucker, GA).

Of these at least six (6) will enter competitions. Based upon experience from past years, at least three other participants are continuing their work and will enter competitions.

One student, who is not listed as a participant in our 1979 NSFSST program because he participated in an NSFSST program at the University of Wisconsin at Stevens Point in 1978, is one of the forty finalists in the 39th Westinghouse Science Talent Search. This student, John W. Vidic (2122 Eighth Avenue, Helena, Montana 59601) worked with Dr. B. R. Livesay, Senior Scientist at Georgia Tech's Engineering Experiment Station. Mr. Vidic's investigation is entilted "Measurements of the Resistivities of Thin Films of Metal Hydrides". He did superior work in the laboratory and reporting on his research, Mr. Vidic participated in all phases of our SUMMER-79 program.

He was supported on campus by funds from private sources; his contributions to Dr. Livesay's research on hydrides (related to hydrogen storage for portable energy sources) more than compensated for any expenses to Georgia Tech to support Mr. Vidic's research.

B. Seminar & Demonstrations Program

Seminars and demonstrations followed closely those outlined in the proposal. Forty three seminars in science, engineering, and mathematics centered around polymer, fiber, and textile science and engineering were presented by members of the faculty of the School of Textile Engineering. Others seminars included one in counselling, one in English composition, and two on computing systems. Seminars and demonstrations accounted for 65 to 708 hours of scheduled time. In the last week of the program, five (5) seminars were devoted to student participants reports on their research. Faculty members and research advisers sat in for reports in which they were involved or interested. Participants were required to attend these seminars which are listed in Aypendix II, pages through .

Seminar leaders and demonstrators were the following eleven faculty members and one staff member of the School of Textile Engineering, Dr. Barbara Winship and Dr. George Williams of the Counselling Center, Professor James Bynum of the English Department, Professor Monte Davis and William H. Downs of the School of Nuclear Engineering, Professor Frances Kaiser of the School of Information and Computer Science, Rand Childs and Cheryl Allen of the Computer Center and the School of Information and Computer Science, Professor D.C. O'Shea of the School of Physics, Professor Paul Mayer of the School of Civil Engineering Professor J. F. Pentecost, Director of the School of Ceramic Engineering and Elinor Plowden of the Engineering Experiment Station.

Name	Degree	Position	Specialty
A.S.Abhiraman	PhD (Fiber Sci)	Asst. Professor	Polymer & fiber science
Cheryl Allen	M.S. (Math)	Systems Analyst, Computer Center	Computers & programming
C. Anderson	B.S. (Text)	Asst. to the Director. TE	Counselling incoming students
D.S. Brookstein	Sc.D. (M.E.)	Asst. Professor, TE	Textile & mechanical Engineering
J.J. Bynum	PhD (Engl.)	Assoc. Professor, Engl., Asst. Dean, Grad. Div.	Composition, Am. literature, poetry
W.C. Carter	PhD (Chem)	Professor, TE	Polymer & textile chem.
C. Cole	B.S. (Text)	Asst. to the Director, TE	Counselling incoming students
F.L. Cook	PhD (Chem)	Asst. Professor, TE	Organic & textile chem.
R. H. Childs	M.S. (Chem)	Systems Analyst, Computer Center	Computers & programming
M.V. Davis	PhD (Phys)	Professor & Director of Nuclear Reactor	Reactor physics and operations
W.H. Downs		Res. Scientist, Nucl. Reactor	Reactor operations
W.D. Freeston	PhD (M.E.)	Prof. & Director, TE	Mechanics & textile Engineering
Paul Hilley	B.S. (Text)	V.Pres. for Manufacturing Coats & Clark, retired	Textile manufacturing
Frances E. Kaiser	M.A. (Libr)	Assoc. Prof. ICS & Librarian	Information retrieval
M. Konopasek	PhD (Phys)	Assoc. Professor, TE	Mechanics & computing
J.L. Lundberg	PhD (Chem)	Callaway Professor, TE	Polymer science
L.H. Olson	PhD (Phys)	Assoc. Professor, TE	Textile & fiber physics
D.C. O'Shea	PhD (Phys)	Assoc. Prof., Phys.	Optics and lasers
W.C. Tincher	PhD (Chem)	Professor, TE	Polymer & textile chem.
Barbara J. Winship	PhD (Psych)	Asst. Dir., Counselling Center	Counselling
George Williams	PhD (Psych)	Counselor, Counselling Center	Counselling

C. Colloquia

Eleven (11) colloquia with speakers from other schools or from off campus were presented. Participants were expected to attend colloquia. About eighteen hours were devoted to colloquia. Speakers, affiliations, and subjects were as follows:

"Metallurgy, etc.", Robert Hochman, Metallurgy Group, School of Chemical Engineering, Georgia Tech

"Psychology at Tech, etc", Barbara J. Winship, Counselling Center, Georgia Tech

"Ceramics", A.T. Chapman & Joe K. Cochran, School of Ceramic Engineering Georgia Tech

"Nuclear Energy in our Future", G.G. Eichholz, School of Nuclear Engineering, Georgia Tech

"Fire Arms, Technology and History", Virgina S. Watts, College of Science and Liberal Studies, Georgia Tech, and Robert C. Watts, Stone Mountain Amory Ltd.

"Psychology, etc.", Ethel Jo Baker, School of Psychology, Georgia Tech

"Industry and Government", James E. Bostic, Jr., Riegel Textile Corporation, Greenville, S.C.

"Engineering Science and Mechanics", Milton E. Raville, School of Engineering Science and Mechanics, Georgia Tech

"Polymer and Petrochemical Research and Development", David C. Bonner, Shell Development Company, Houston, Texas

"Mechanical Engineering, etc", Stothe P. Kezios, School of Mechanical Engineering, Georgia Tech

"Model Building for a Microcentury", John Neff, School of Mathematics, Georgia Tech

D. Emphasis on English

Professor James Bynum of Georgia Tech's English Department conducted one seminar on English. He explored with the student participants our need for good command and use of written English. Professor Bynum communicates well with students. He convinced several that their study of English is as

necessary as is mastery of mathematics and science, subjects which out SSTP participants usually favor. Several of the members of the Georgia Tech faculty believe that English in our most important subject. We encourage our students to improve their use of the language; we do the same in our SST program.

E. Computing Seminars

Mr. Rand Childs, Systems Analyst in the Office of Computer Services at Georgia Tech, arranged seminars and guided tours of the computing facilities; students went in two groups on the second day of the program. On the first, fourth and fifth days Professor Milos Konopasek led working seminars on computers and introducted students to the small computers and the remote stations in the School of Textile Engineering.

Cheryl Allen, Systems Analyst in the Office of Computer Services at Georgia Tech and PhD degree candidate in Information and Computer Science, conducted seven (7) two hour sessions on programming, use of the Control Data Corporation "Cyber 74" system, PDP-8 computers, and the "Calcomp" plotter. Attendance at these computer seminars was voluntary. Mrs. Allen had worked with participants in our 1975 - 1977 programs; her return to the Tech campus and working with our 1979 participants strengthened the computer activities in our SST program. In addition, Mrs. Allen and other members of the Georgia Tech Computer Center's staff served as willing programming counselors to introduce our SSTP participants to computing. All students were provided with necessary account numbers, identification, etc. so that they could use the computing facilities at Georgia Tech. Most students played games on the computers; about one third of the students used the computers for work; a few became adept at computing and playing computer games.

Professor Milos Konopasek and Mr. Craig Anderson introduced SSTP participants to the remote access terminals to the big computer on campus and to the small computers in the School of Textile Engineering. Professor Konopasek offered as much time and help as students desired in learning to use his question and answer system and to learn programming and use of the large "Cyber-74" Computer.

F. Counseling

Dr. Barbara Winship and Dr. George Williams of the Student Counseling Center at Georgia Tech met with the students the third day of the program. Nine days later the participants visited the Counseling Center; Dr. Winship and Mr. Parker met with and spoke to them. In this way, participants became aware of some of the help available from these dedicated and able psychologists. In their discussions, Mr. Parker, Dr. Winship and Dr. Williams discussed the transition from home to college life the participants were experiencing and would face again in a little over a year, some of the ways to develop effective study habits, and how the participants might help themselves to enrich their experience in our SST program. Again this year, Mr. Parker was particularly helpful in communicating with some of the minority group participants.

G. Special Seminars on Advanced Subjects and Seminars Requested by Student

Special seminars on mechanics, thermodynamics, quantum mechanics, statistical thermodynamics and subjects requested by student participants were offered. From about six to twenty students participated.

Professors Winston Boteler, David Brookstein, Denney Freeston, Milos Konopasek, and Howard Olson's special seminars on continuum mechanics were particularly well received. These colleagues are good teachers. They are most successful in introducing students to continuum mechanics, a subject

omitted in courses in physics and from too many college curricular. These seminars were:

A-1 "Stress and Strain", D. B. Brookstein, June 21, 1979

A-2 "Analysis of Stress & Strain", W. D. Freeston, Jr., June 28, 1979.

A-3 "Torsion", L. H. Olson, July 5, 1979.

A-4 "Shear Force and Bending", W. C. Boteler, July 12, 1979.

A-5 "Bending Stiffness and Deflection of Beams and Columns", Milos Konopasek, July 19, 1979.

A-6 "Statics of Rigid Bodies", W. C. Boteler, July 26, 1979

Special seminars in advanced subjects in physics and chemistry included:

B-1 "Newton's Mechanics and Conservation of Energy" - June 19, 1979.

B-2 "Thermodynamics - First Law" - June 26, 1979.

B-3 "Thermodynamics - Second Law" - July 3, 1979.

B-4 "Thermodynamics - Carnot Efficiency, Energy, Work and the Crunch", - July 10, 1979.

B-5 "Quantum Mechanics by Max Planck" - July 17, 1979

B-6 "More from Max Planck and Somthing About Wave Equations" - July 26, 1979

B-7 "Wave Mechanics" - July 30, 1979.

J. L. Lundberg led these seminars. Students were given extensive notes.

H. Field Trips and Visits

The SSTP group visited the Fernbank Science Center on Thursday afternoon June 28, 1979. They heard and saw a special planetarium show, visited the observatory, and enjoyed walking the nature trails. Dr. R. A. William on, staff astronomer, was host.

We visited Callaway Gardens at Pine Mountain, Georgia, on Saturday, July 14, 1979. Dr. Robert Pedigo, Director of Education at Callaway Gardens,

conducted an extensive tour of the gardens with discussions and questions. A few of the students really appreciated the beautiful reclamation of worn-out cotton land and the fine developments in applied botany exemplified by Callaway Gardens.

Our SSTP students visited the nylon marufacturing plant of the American Enka Company at Central, South Carolina, on July 24, 1979. Here they learned about and saw polymerization of caprolactam to nylon-6; the purification of nylon-6; fiber spinning, drawing and texturing; laboratory testing and fabric and carpet making, dyeing, and evaluation. On the same trip they visited the Duke Power Company's Oconee Station, a nuclear-hydroelectric complex with three reactors and steam generators, three lakes at different levels, and water conduits and generator and pumping systems. Again this year we could not visit the power house. Such areas are closed to large groups for security reasons. These regulations imposed by our government keep the wrong people out; students are denied some on site insight into nuclear energy. In past years students could gain some appreciation of the extremes to which we most go to satisfy our large needs for energy. To stand on the power house floor as the generators deliver close to three billions watts dramatizes the magnitude of energy problems.

All students visited the following schools, centers, and facilities on the Georgia Tech Campus:

Date	SITE	HOSTS
June 18	Georgia Tech Library	Professor Frances Kaiser, Librarian
June 18	Student Center for ID Cards	
June 19	School of Chemistry	Professor J. Aaron Bertrand, Director, and Professor James A. Stanfield, Assistant Director
June 19	School of Ceramic Engineering	Professor Joe K. Cochran
June 19	Georgia Tech Computer Center	Rand H. Childs, Systems Analyst
June 20	School of Physics	Professor D. C. O'Shea
June 20	Georgia Tech Nuclear Reactor	Professor M. V. Davis, Director, and W. H. Downs
June 21	School of Civil Engineering	Dr. Paul Mayer, Regents Professor
June 21	School of Aerospace Engineering	Professor A. L. DuCoffe, Director
June 21	School of Textile Engineering Laboratories	Craig Anderson, Assistant to the Director
June 22	School of Electrical Engrg.	Professors David L. Finn and Thomas M. White
June 22	Engineering Experiment Station	J. L. Brown and B. R. Livesay, Senior Scientists, and Elinor Plowden
June 29	Georgia Tech Counseling Center	Dr. Barbara J. Winship and Thomas A. Parker, Counselors

In each of the visits, extensive demonstrations, briefings as to function, and question and answer sessions were provided. Professor Frances Kaiser's introduction to the library is excellent; the participants used the library and checked out books starting on the first working day of the program, Monday, June 18th. The visit to the Engineering Experiment Station included a seminar and slide show presentation showing the diversity of activities (by Miss Elinor Plowden), a visit to and demonstration of electron microscopy

facilities (Mr. J. L. Brown), and a visit to the laboratories and demonstration of the techniques of micromechanics and magnetic phenomena (Dr. B. R. Livesay).

I. Science Movies

Motion pictures on science and engineering were shown four nights weekly in the first two weeks of the program. Attendance was optional. A list of movies shown is given in Appendix III.

J. Recreational and Group Activities

SSTP participants enjoyed twenty (20) recreational and group activities in the 48 days from Sunday, June 17, through Friday, August 3rd. Average intervals between activities was 2.4 days; the longest interval was six days. Teenage young people need and want both planned, group recreation and unstructured, unplanned activities. Campus recreation facilities and teen-age creativity combine to provide sufficient of the latter. The Student Athletic Complex at Georgia Tech was a real attraction for SSTP participants as it is for the students and faculty. This large and varied facility is for students, not for intercollegiate athletics.

The Atlanta Symphony Orchestra plays in Symphony Hall close to the Tech campus. A few students attended concerts there. As part of the summer program of the Atlanta Parks and Recreation Department, the Atlanta Symphony gave five concerts on Sunday evenings in nearby Piedmont Park. These delightful, family picnic concerts were well attended. Our SSTP participants enjoyed four of these concerts taking picnic suppers along on three occasions.

Motion pictures are shown on campus on Friday evenings during the summer. On Saturdays, when no group activity was planned off campus, the

students had informal parties in the lobby of the School of Textile Engineering. Mr. Craig Anderson and the faculty members supervised these social activities. No funds provided by the Foundation can be or were used in any way to support recreational or group activities. A listing of these activities is given in Appendix IV.

K. Communication

Communications among participants, staff and faculty were good in 1979. Of course gaps did exist; we do not listen carefully to one another. To facilitate communication we used the following channels: 1. Weekly programs (schedules) were provided to each student. 2. Orientation and question and answer sessions were held by faculty members, Mr. Craig Anderson, and Mr. Charles Cole, and student dormitory counselors, Miss Susan Rochrer, Mr. Gordon Davis and Mr. Jeff Appling. 3. Meetings among SSTP participants, Georgia Tech students, faculty staff, and participants in our past SST programs in the lobby of the Textile Engineering Building. 4. Visits by Mr. Anderson, Mr. Cole and faculty members to dormitories. 5. Faculty members and SSTP participants eating together at lunch and supper. 6. Faculty members keeping open doors to their offices and visiting laboratories to talk to and help participants. 7. Keeping contact with Dr. Barbara Winship and Mr. Tom Parker in the Counselling Center. A few students would communicate with these counselors but not other Tech personnel.

Mr. and Mrs. Craig Anderson live almost on campus in a house across the street from the dormitories in which the participants were housed. His presence and the relative ease with which students communicate with him contributed much to good communications in 1979.

IV. Results of the Program: Evaluation

A. General

The 1979 SST program was our seventh, annual program at Georgia Tech. Several participants from our first program who came to Tech have graduated. Several from the second program have graduated; a few are seniors. Participants in the third and fourth programs are seniors and juniors. Participants in our 1979 program are freshman and sophomores. Two of the 1979 program participants are attending Georgia Tech full time or in joint enrollment. We have observed closely the performance of these students at Tech; almost all have done well (GPA from 2 + to 4.0 out of 4.0). A few have done excellent work in undergraduate research. Based upon their performance to date and upon past participants' statements, we believe that our 1973-1979 programs were successful and that our 1979 program will have served as well as any of our earlier programs in developing science and engineering students.

B. Assessment of Research Results in the 1979 Program

The program director graded the research activity of each of the participants for this report. Grades are based on: 1. students' research reports, 2. estimates of performance by research advisers, 3. observations of and conservations with participants in the laboratories, and 4. general impressions by faculty members, other students' research advisers and the program director. Estimates of research performance compared to estimates of abilities of applicants (as given in Table I, page 7) are given in Table II. Estimates are grouped for participants with good to excellent opportunity and encouragement to study science, those with limited opportunity and/or encouragement, rising juniors, and for all participants. (The grade, "Good", with grade point 2.0 (C) is characteristic of abilities and work of students whom we would welcome to

TABLE II

Comparison of Estimates of Students Abilities with Estimates of Their Research Performance, 1979 SST Program

Group	Estimated Potential as Applicants	No. of Students	Estimates of Research Performance: Superior A=4	Excellent B=3	Good C=2	Fair D=1	Poor F=0	Average GPA
All Students	Gifted (A=4)	4	3	1	0	0	0	3.75
	Very Good (B=3)	23	6	13	3	1	0	3.04
	Good (C=2)	22	1	11	7	2	1	2.41
	Fair (D=1)	7	0	5	1	1	0	2.57
	Poor (F=0)	0	0	0	0	0	0	-
	Average/Total	2.43/56	10	30	11	4	1	2.71
Good to Excellent Opportunity	Gifted (A=4)	4	3	1	0	0	0	3.75
	Very Good (B=3)	15	4	9	1	1	0	3.06
	Good (C=2)	3	0	1	1	1	0	2.
	Fair (D-1)	1	0	1	0	0	0	3.
	Poor (F=0)	0	0	0	0	0	0	-
	Average/Total	2.96/23	7	12	2	2	0	3.04
Limited Opportunity	Gifted (A=4)	0	0	0	0	0	0	-
	Very Good (B=3)	8	2	4	2	0	0	3.
	Good (C=2)	19	1	10	6	1	1	2.47
	Fair (D=1)	6	0	4	1	1	0	2.5
	Poor (F=0)	0	0	0	0	0	0	-
	Average/Total	2.06/33	3	18	9	2	1	2.61
Rising Juniors	Gifted (A=4)	1	1	0	0	0	0	4.
	Very Good (B=3)	3	1	2	0	0	0	3.33
	Good (C=2)	4	0	3	1	0	0	2.75
	Fair (D=1)	1	0	1	0	0	0	3.
	Poor (F=0)	0	0	0	0	0	0	-
	Average/Total	2.44/9	2	6	1	0	0	3.11

Georgia Tech as students of engineering, science, or mathematics). Six of the seven students whose potential was estimated as fair (D=1) performed beyond expectations. As in past years, students with limited opportunity and/or encouragement in science did better in their research than we expected, performance GPA $\sim$2.6 compared to expectations GPA $\sim$ 2.1. Students with good to excellent opportunity performed (GPA $\sim$ 3.0) as well as expected (GPA $\sim$ 3.0). The nine (9) rising juniors' predicted performance was GPA $\sim$ 2.4; their actual performance was better than this, GPA $\sim$ 3.1. Four participants did D=1.0 work, and one student's work was unsatisfactory (F=0.0) . Each year we are more critical in grading participants' performance because students show us how well they can do in their research; each year's participants set higher standards for those who follow. We were particularly critical in our estimates in 1979; we made no overestimates. We try to judge SSTP participants on the same basis we try to measure research performance of Georgia Tech undergraduates in special problems courses taken in Tech students' senior years. Estimates of potential are the same as those for entering freshmen; we make no allowance for difference in age and years of schooling.

Comparison of estimates of ability and performances supports our belief that the necessary and almost sufficient condition for success is desire; ability as measured by tests and grades is secondary. Of course, class rank often correlates with desire. Based on exam scores all of the participants should enter college.

Our estimates of average potential of and performance by participants in the last six (6) SST programs at Georgia Tech:

Year	Number of Participants	Estimated Potential	Estimated Performance
1974		2.5	2.5
1975	37	1.8	2.6
1976	53	2.0	2.6
1977	44	2.4	2.9
1978	49	2.6	3.0
1979	56	2.4	2.7

In 1978 we had more "gifted" prospects than in previous years. In 1979 we had about as many as in 1978 in the "very good" categories. Faculty and staff concensus is that our 1978 group was the best yet and that the 1979 group was better than the earlier groups. Again in 1979, we had no "gifted", lazy participants.

The participants in the 1979 SST program profited from it. Almost all worked at least reasonably hard. In this respect, the 1979 group was as good as the 1978 group and better than the 1977 group which was as good or better than the earlier groups. All but one of the participants in our 1979 program can "make it" in college; they are good prospects. Almost all of the participants can do well in engineering or science.

In 1979, three participants worked on architectural design projects. One of these can be a good architect; he probably will study engineering and medicine.

Outstanding research problems in 1979 were as follows:

1)	Ruth S. Alexander (Senior)	"Construction of an Oscilloscope" J. L. Lundberg, Textile Engineering
2)	Catherine M. Algeo (Senior)	"Further Development of the Question Answering System (QSA): Model Solving with Simultaneous Equations" M. Konopasek, Textile Engineering
3)	Geoffrey W. Cundiff (Senior)	"Design of a Zero Energy House" J. L. Lundberg, Textile Engineering

4)	Michael T. Fitzpatrick (Senior)	"Studies of Polymerization of Acrylonitrile Using 18-Crown-6 Ether to Enhance Yields and Molecular Weights" - F.L. Cook, Textile Engineering
5)	Edward P. Flinchem (Junior)	"Studies of the Mathematical Characterization and Manipulation of Knots" M. Konopasek, Textile Engineering
6)	Howard J. Ilvicky (Junior)	"Synthesis and Characterization of 4' Vinyl benzo 18-Crown-6 Ether", F. L. Cook & R. Robertson, Textile Engineering
7)	Susan R. Luhrman (Senior)	"Separation of Photographs from Multiply Exposed Films" - W.T. Rhodes & S. J. Henriksen, Electrical Engineering
8)	Gerald S. McGlamery, Jr. (Senior)	"An Analysis of the Use of Knitted Fabrics in Filter Bags for Control of Air Pollution" - L. H. Olson, Textile Engineering
9)	Gilbert C. Milner (Senior)	"A Study of the Theory of Knots" M. Konopasek, Textile Engineering
10)	Robert B. Mock (Senior)	"Construction of a Home-made Electron Microscope" - S. Charkabortty, Metallurgy Group, Chemical Engineering
11)	John Vidic (Senior) (Finalist in Westinghouse Science Talent Search)	"Measurements of the Resistivities of Thin Films of Metal Hydrides" B. R. Livesay & J. Larson, Engineering Experiment Station
12)	Eileen E. Webb (Senior)	"A Study of Fermentation of Kudzu to Produce Ethanol" - R. S. Roberts & D. L. Johnson, Chemical Engineering
13)	Elaine A. Webb	"Studies of the Use of Gamma Radiation to Decompose Organic Material in Water Purification" - G. G. Eichholz and colleagues, Nuclear Engineering

C. Students' Evaluation of the Program

Students evaluations of the Georgia Tech SST program were favorable, but with good, constructive criticism. The twenty-eight (28) responses to the questionnaire in Appendix V (with numerical results) permit us to conclude:

1. Students are programmed for one hour classes; the 1 1/2 hour seminars were too long for many of the 1979 participants.
2. Freshmen to junior levels in college probably is about the right level for seminars. Most students must "reach" for understanding most of the time; they should have to reach if they are learning.
3. Seminars of greatest interest to students ranged over a variety of subjects from psychology to a "dog and pony" show on textiles and polymers and chemistry, textile applications, mechanics, fire arms, chemical engineering and materials, and thermodynamics.
4. Subjects of least interest included chemical bonding, polymers, firearms, and computing.
5. About half of participants thought that thirteen "outside" speakers in twelve colloquia were too few; the other half said that we had sufficient colloquia.
6. A good fraction of the students would welcome more material in seminars; half thought we covered the right amount of material.
7. We offer sufficient research problems to satisfy diverse interests of participants.
8. Two thirds of the students rated faculty assistance in research as excellent or good.

9. Two thirds of the students found procuring materials and instruments to be easy; for one third this was difficult.
10. The same amount of time or more time should be devoted to research.
11. Participants attended optional seminars. Thermodynamics, computer programming, quantum mechanics, continuum mechanics, and admissions to Georgia Tech seminars were remembered by students. Almost all who attended special seminars said they learned something citing computer programming (FORTRAN), some understanding of thermodynamics, and principles of mechanics as definite gains.
12. Participants said that they would have attended optional seminars in English, mathematics, biology, electronics, and chemistry had these been offered.
13. More time should be spent familiarizing students with Georgia Tech's research activities.
14. More time or the same amount of time should be devoted to familiarizing participants with Tech's instructional, resource, and service facilities. These are so diverse, and students' interests are so varied that familiarizing students must be done on an individual basis. If the pariticipants seek help and information, the staff and faculty members of the School of Textile Engineering expend much effort in satisfying these wants, usually with too much information.
15. Students like organized outings; time, financial resources, and stamina of faculty and staff limit these. In 1979, students thought we had enough organized outings.
16. The trip to Six Flags over Georgia was the favorite outing; this has been the favorite outing in past years. Visiting Stone Mountain Park, Lake Hartwell (in the rain), and Piedmont Park for concerts of the Atlanta Symphany Orchestra were least favored.

17. Monies, gasoline, time, and faculty stamina permitting, some of the outings suggested by 1979 participants will be included in our 1980 SST program.

18. One or two more field trips to the Communicable Disease Center and a textile,automobile, or air craft plant will be included in the 1980 program.

19. A slight majority of the 1979 student participants thought they had enough free time; a large minority would have enjoyed more time to sleep.

20. Doing research, sleeping, participating in social activities, participating in athletics, and enjoying recreation were listed as favored activities were more free time available.

21. A strong majority of the participants liked our SST program as it was run in 1979, or with a few changes.

22. We should continue to emphasize research.

23. A number of the students praised the program with superlatives.

D. Good Points of the Program

Research was our chief activity; the fun of research and satisfaction from accomplishment were the chief benefits to participants in the program. Most students got real results in their work. A few projects with significant results are listed on pages 35 and 36.

Each year we can and do offer a greater diversity of research problems and find research advisers for a wider range of research suggested by participants. This is thanks to enthusiastic participation by colleagues in other schools and centers at Georgia Tech. In 1979, projects in architectural design were offered for the third time. With greater diversity of research problems, special seminars in advanced chemistry and physics, visiting colloquim speakers, and additions to variety of material presented in the seminar program, our program has become more diverse. We find that students learn chemistry and physics at least as easily using macromolecular systems with the reference state a partially ordered composite structure as using the usual small molecule compounds with the ideal gas and sodium chloride crystal as reference states.

Colloquia with outside speakers were well received. For the seventh year, Dr. James E. Bostic of the Riegel Textile Company and formerly Deputy Assistant Secretary of Agriculture, came to vist and lead a discussion in our SST program. Dr. Bostic is a favorite with the students.

Our colloquium speakers included one minority member and three women. Judging from our students' reactions and comments, including at least one minority member, who communicates well with people, is essential.

Dr. James Bynum's contributions in helping participants appreciate the importance of English and suggestions to help them to write and speak

better were needed and appreciated. Early in the program participants knew that English is their most important subject.

Students used the computers as much in 1979 as in 1978 and more than in previous years. Serious, useful computing increased. Several participants used computers extensively in their research. Mrs. Cheryl Allen of the Computer Center and Professor Milos Konopasek of the School of Textile Engineering introduced participants to computing.

The special seminars on mechanics were superb and popular. Special seminars on Newton's mechanics, thermodynamics, quantum mechanics and statistical thermodynamics were well received. From ten to fifteen students participated. High School students seem to understand Max Planck quite well; we used his 1901 paper as text material. Students appreciated Professor Joh Neff's colloquium on mathematics. We spent no seminar time on subjects which are college preparatory or offered in high school.

Nature knows no disciplines; she needs no interdisciplines. Introducing students to science, engineering and math in this manner is easy. Comments from past participants about this and the ease with which 1979 participants learned give credence to the thesis that teaching math, science, and engineering together with many examples familiar to the students make easier the learning and gives relevance to otherwise abstract ideas. Too often we forget that nature and students do not require and the latter do not appreciate dividing studies into disciplines; rather, these artificial divisions hamper learning.

We suffer from "mathsmanship" in science and engineering. Students study physical chemistry in high school and as freshmen; physics must be "calculus based" rather than founded on physical experience, and engineering

must strive for linear analyses as an end. Such mathematic manipulation "turns off" many creative students. We emphasize physical and chemical experiences in our introducing SST program participants to science and engineering. Most respond well with lively interest. We wish this would continue in their undergraduate experience.

Many students are sheltered to the extent that they haven't been in a factory, for example. Therefore, the visit to the nylon plant and nuclear power station is a real "eye opener."

Miss Susan Rohrer participant in our 1976 SST program and a junior majoring in textile engineering, was the girls' counselor in 1978. Miss Rohrer was an outstanding counselor for the girls; her kindness and sensitivity were appreciated. Boys counselors were Mr. Gordon Davis, who participated in our 1976 SST program and is a senior majoring in biology and headed to medical school, and Mr. Jeffrey Appling, a senior in textile chemistry who will seek his Ph.D. degree in physical chemistry. Two counselors were needed to supervise thirty-five (35) boys in the dormitory. Mr. Craig Anderson, Assistant to the Director of the School of Textile Engineering, lived close to the buildings in which the participants were housed. Mr. Anderson's presence, close to the students, was of real help.

A larger fraction of students (89%) lived on campus in 1978 and 1979 than in previous years. Nine (9) students who could have commuted lived on campus by choice. Their parents invested wisely the additional costs of board and room.

Most students adjusted well to campus life. One or two of the boys did not get over the horseplay in the dormitory stage until the end of the program. The program helped many to cope with being away from home

and living on campus, without the penalty of failure. A few of our participants probably would fail in college without this experience.

Out 1978 and 1979 groups were more articulate and able than our past SSTP groups. As a group these were more critical than previous groups, but constructively so. That they liked the program and associations was demonstrated by 55 percent attendance at their reunion in January.

E. Problems

Perhaps our most difficult task is to help SSTP students to develop some feeling for the nature and breadth of science and engineering and for the diversity of opportunities they will enjoy in college and after. Most students know only structured, discipline-oriented, over-organized and dogmatic secondary schools which do not prepare them for college. Most SSTP participants have little feel for the experimental method and deductive reasoning. Compared to our 1973-77 programs, more of our 1978 and 1979 participants evidenced healthy skepticism to doubt, question, and test what they see, read, and hear. If participants are to have meaninfgul experience in SSTP research problems, much faculty time is required for necessary one on one tutoring and help. We believe that we of the School of Textile Engineering and our colleagues in other Schools at Georgia Tech have made that commitment of time. The 1978 and 1979 participants were more able and inquiring than any previous group and more productive than those in our 1973-1978 SST programs.

The commuters who are not outgoing and gregarious do not become part of the group to nearly the extent that those who live on campus do. We have tried to lure these people to our weekend outings, we had more success in 1979 than in previous years. Of the six (6) commuters, two (2) partici-

pated in all weekend activities, and two (2) others in some of the planned recreational activities.

Again in 1979, we had no overt racial problems. Most SSTP participants developed good rapport and real affection for one another. Communication with blacks who seek only blacks as companions remains a problem for whites and members of other minority groups. One young man, a black from an all black high school in rural Georgia, was teased and the object of pranks and horseplay, because of his naivete rather than his color. He returned to Tech for the group's reunion in January and mixed with and enjoyed the commraderie of the group. Eleven (11) of the 56 participants are black, two are Hispanic Americans and two are Asian minority.

In the jargon of our time, we have tried to be supportive of students rather than supportive of minority members. Most have responded well to this deemphasis of race and ethnic group.

The help of Mr. Thomas Parker in communicating with our black students is most valuable. We, who are concerned with our SST program, are most grateful for his unique contribution to the program.

F. Changes in Future Programs

In future programs as shall try to continue to increase the diversity of research problems available. Further, we shall continue to encourage participants to suggest their own problems; nine (9) participants did so in 1979. Because of the diversity of ongoing research at Georgia Tech and the willingness of investigators to add research students to their groups or to branch out into new areas of investigation, we can find research advisors and facilities for most problems suggested by participants.

We had more projects in "go" condition in 1978 and 1979 than in other years. More participants found equipment and materials as easy or easier to obtain in 1979 as in 1977 and 1978 and easier than in previous years. We shall try to improve.

In 1980, we shall broaden our program some. At the junior-senior level in high school, students should be exposed to the diversity and breadth of science and engineering so that they become aware of and perhaps interested in areas of science and engineering of which they may remain ignorant. Students can't study in fields of which they are unaware. The diversity of material in seminars will be increased some.

We have emphasized that students need not worry about deciding on majors fields of study. The constant pressure from teachers, counselors, college admissions officers, deans, and parents to elect majors bothers most students who really don't know what they want to study. Therefore, we have urged students to be undecided engineering or science majors and to take math, chemistry, and physics suitable for majors in each of these disciplines and the best English courses on campus. Further, we stress that as long as they take the "high road", choice of major is not as important as deans and registrars would have us believe. Taking the good courses suitable for majors in each discipline keeps options open. Further, we suggest that students group their elective courses and take what is in effect a second major. We try to orient our SSTP participants in this way and to wean them for their excessive cleaving to disciplines, curricula, etc.

We shall increase our efforts to make all commuters feel more a part of the group. Since young people will communicate with one another better than with adults, we will continue to ask our counselors and the participants to seek out the commuters and to include them in spontaneous on-campus activities in free time.

G. Effects of the Program

The effect on participants was to increase in each an appreciation science and engineering and an eagerness for real study at the university level. The SST program is excellent for recruiting good students to good schools. Seeing science and engineering first hand at Georgia Tech caused a few students to reconsider their plans to study other majors and turn to science and engineering including polymer, fiber, and textile science and engineering. One participant who had no intention to come to Georgia Tech or to study in our field is here now studying textile engineering.

One immediate result of our 1979 SST program was that in August, 1979, one of the participant's family moved from a small town east of Atlanta to Dekalb County in the Lakeside High School area so that this participant could attend one of the better high schools in Georgia. Such decisive and prompt action as a result of experience in an SST program is rare.

One of the participants, Miss Catherine Algeo, brought the Mathematics Club and three (3) mathematics teachers at Cedar Shoals High School, Athens, Georgia, to the Georgia Tech campus on February, 1980. This group enjoyed a superb seminar on "Finite Difference Equations" by Professor Nathaniel Chafee of Tech's School of Mathematics and visits to the Computer Center and the laboratories of the Schools of Electrical and Textile Engineering.

Another effect of the program on some of the participants was to help some of the participants to "aim higher," at better colleges and universities in more difficult curricula. This broadening of interests and horizons and the realization that they can "make it" in the better schools means that at least a few of the fifty-six (56) students, who participanted in the whole program, probably will register in science or engineering curricula

in strong schools instead of beginning in less demanding curricula in lesser schools.

At least eleven (11) of the students are continuing to work on their research problems and will enter local and national competitions.

Most of the students in our 1979 program developed the real friendship for one another that was obvious in the 1973-1978 groups. The 1979 group enjoyed being together, enough that thirty (30) came to Georgia Tech on January 10-13, 1980, for a reunion. This regard for one another and communication among most students bridged differences in economic status, background, preparation, sex, and race. The participants learned more from each other than from faculty and staff.

The principal effect of the 1973-1979 programs on the School of Textile Engineering is that we started or pushed forward some research programs which would have languished without this spur. Of the thirty-three (33) problems worked on by students in 1979 in the School of Textile Engineering, three (3) were suggested by participants and eight (8) received principal impetus from SSTP problems; work on at least eight(8) of the thirty-three (33) problems continues.

Another, almost equally profound effect upon our school was as in previous years to acquaint us further with and make us much more sensitive to hopes, needs, thinking, problems, strengths, and weaknesses of young people who are likely candidates for science and engineering. We learned how to reach several of these people through their schools, families, etc. The School of Textile Engineering will continue to increase its contacts with potential students of science by visiting more schools, giving more seminars and demonstrations in schools, helping more teachers and students with research

projects and demonstrations, entertaining more visiting students and teachers at Georgia Tech, etc.

As a direct result of our SST programs, the Atlanta City Schools held their annual Science Congress in the School of Textile Engineering in 1977 and 1978. This science fair with student presentations has increased in size so that the congresses were housed in the Schools of Ceramic, Civil and Textile Engineering and Physics in 1979 and 1980. About four hundred students demonstrated their research and project work in 1979 and 1980. Georgia Tech and its chapter of Sigma Xi will be hosts for the 1981 science congress of the Atlanta schools.

H. Follow-up on the program

Follow-up on the program has continued since the end of the students stay on campus. All participants in the 1979 program have received at least three letters from faculty and staff of the School of Textile Engineering. All received a questionnaire requesting participants' reactions to the program; twenty-eight (28) participants responded. All have received a group picture in color. Georgia Tech faculty members are helping nine (9) of the participants to continue working on their research programs.

Thirty (30) student participants come to the campus as guests of the faculty on January 10-13, 1980, for a reunion, recreation, and fellowship. Those attending came from Georgia, Florida, South Carolina, Texas, and Puerto Rico. On Thursday and Friday evenings, January 10 and 12th, open house and informal parties in the School of Textile Engineering were enjoyed by students and faculty. Friday was devoted to counselling students interested in attending Georgia Tech; academics. admissions, financial aid, housing, athletics, and campus activities were considered

by appropriate organizations on campus. The group ate suppers together on Friday and Saturday; fun on Saturday included a roller skating party and attending a Tech basketball game. The reunion ended on Sunday with "brunch" and open house at the Lundberg home with forty plus students, faculty, and counselors present.

V. Suggested Improvements in the National Student Science Training Program

This program is excellent; it reaches young people at the right time to save a few for science in spite of the thrust of secondary education away from science and other difficult disciplines. Further, our SST program makes some students aware of the diversity of opportunities for study in science and engineering and that many paths lead to similar goals. Students have to know the existence of different curricula and study programs before they come to college if they are to consider enrolling in them.

The Foundation's staff knows better than we the three biggest improvements which can be made in the program. These are:

1) adequate funding for 200 plus individual programs and
2) announcing grants before September first of each year to give adequate time for publishing programs and seeking additional funds for the following summer.

Acknowledgements

Mr. Craig Anderson, Assistant to the Director of the School of Textile Engineering, cared for most of the housekeeping, travel, and activities arrangements for the program. He also served as an extra, full time counselor for student participants. His contributions to the program made the program go; his easy, friendly empathy facilitated communication with participants.

Dr. W. Denney Freeston, Jr., Professor and Director of the School of Textile Engineering, worked in the SST program days, nights and weekends as research adviser, seminar leader, counselor, chaperone, chauffer, mechanic and administrative supporter. His enthusiastic participation and encouragement insured success of our 1979 SST program.

Dr. Walter C. Carter, Professor of Textile Engineering and find textile and polymer chemist, has contributed more to our 1973-1979 programs than any other member of our faculty in helping students with research problems. He is always willing to help students with research problems of wide diversity, from botany to chemistry.

The many members of the faculty, staff, and students of Georgia Tech listed on pages 19, 20, 24, 25, and 30 plus an equal number whose names don't appear and friends at Fernbank Science Center, American Enka Company, Duke Power Company, and Callaway Gardens made our 1979 SST programs a success.

Our friends in industry, who contributed $4550, made possible field trips, recreation for participants, and the participation of at least the extra seven (7) students in our 1979 program.

APPENDIX II - Seminars & Demonstrations

1. "Our World of Giant Molecules" - J. L. Lundberg
2. "Stress-Strain Behavior of Materials" - W. D. Freeston
3. "Equilibria, Static and Dynamic" - J. L. Lundberg
4. "Near Equilibrium Kinetics" - J. L. Lundberg
5. "Viscoelasticity of Polymers" - A. S. Abhiraman
6. "Molecular Size" - W. C. Carter
7. "Periodicity & Chemical Bonding" - W. C. Tincher
8. "Carbon to Carbon Bonding & Vinyl Polymerization" - W. C. Tincher
9. "Vinyl Polymerization of Copolymerization" - J. L. Lundberg
10. "Chemical Bonding, Covalent & Ionic" - J. L. Lundberg
11. "Chemical Bonding: SiO_2 & Other Oxides, Salts, Inorganic Compounds, Metals, etc." - J. L. Lundberg
12. "Chemical Bonding: Carbon to Oxygen - Chemistry of Ethers, Alchols, Acides, Esters, etc." - W. C. Carter
13. "Chemical Bonding: Carbon to Nitrogen" - W. C. Carter
14. "Polyamides: Nylon & Proteins" - W. C. Carter
15. "Polyethers: Cellulose and Starch. Polyesters: PET, DNA, RNA, etc." - F. L. Cook
16. "Rate Phenomena & Differential Calculus" - J. L. Lundberg
17. "Rates of Chemical Reactions" - W. C. Carter
18. "Summations and Integral Calculus" - J. L. Lundberg
19. "Average Molecular Weights" - J. L. Lundberg
20. "Polymers & States of Matter" - J. L. Lundberg
21. "Flow of Polymers" - A. S. Abhiraman
22. "Rubber Elasticity" - L. H. Olson

23. "Crystallization of Polymers" - W. C. Carter

24. "Skructure and Morphology of Polymers" - J. L. Lundberg

25. "Fiber Extrusion, Drawing and Texturing" - D. S. Brookstein

26. "Fiber Properties" - J. L. Lundberg

27. "New Fibers" W. D. Freeston

28. "Yarn Formation: Old, and New" - D. S. Brookstein

29. "Fabric Formation" - D. S. Brookstein

30. "Color" - W. C. Tincher

31. "Chemical Preparation of Textiles" - F. L. Cook

32. "Dyeing" - W. C. Carter

33. "Finishing of Textiles" - W. C. Carter

34. "Designing with Fibers" - W. D. Freeston

35. "Composite Structures, Fabrics, etc." - D. S. Brookstein

36. "Engineering Applications of Fibers" - W. C. Freeston

37. "Carpets: Ancient Asia to Dalton, Georgia" - W. C. Carter

38. "Automation and Control" - L. H. Olson

39. "Environmental Problems" - J. L. Lundberg

40. "Energy, Polymers, Fibers, etc." - F. L. Cook

41. "Food, Fiber & Shelter" - J. L. Lundberg

42. Research Reports by Participants

43. Research Reports by Participants

44. Research Reports by Participants

45. Research Reports by Participants

46. Graduation": Presentation of certificates of participation and mementoes participants, parents, faculty, staff, and friends.

Extra Seminars

"Using the Georgia Tech Library" - Frances J. Kaiser

"Counselling at Tech, Effective Study Habits, Communicating, etc." - Barbar J. Winship, Thomas A. Parker and George Williams

"Playing with Computers" - Milos Konopasek

"English is Fun" - J. J. Bynum

"The Georgia Tech Computer Center" - Rand H. Childes

"Civil Engineering and TECH" - Paul Mayer

"Aerospace Engineering at Georgia Tech" - Arnold L. DuCoffe

"The Georgia Tech Reactor" - Monte V. Davis

"The Engineering Experiment Station" - Elinor Plowden

"Lasers and Optics" - D. C. O'Shea

"Computers, Programming, and Computing" (6 sessions) - Cheryl Allen

"The Craig Anderson Show: Fun with Textiles, Fibers, Polymers, etc." - Craig Anderson

"College Admissions, Tech, etc." - Craig Anderson

APPENDIX III - Group Activities - "SUMMER-79" NSFSSTP

Date	Activity
Sunday, June 17	Open house & "Dutch treat" supper with parents and friends - Textile Engineering Building.
Wednesday, June 20	Get acquainted party - Textile Engineering Building
Saturday, June 23	Visit Stone Mountain-hiking, swimming, canoeing, etc.
Sunday, June 24	Visit High Museum of Art and Peachtree Plaza Hotel; Atlanta Symphony Concert in Piedmont Park.
Friday, June 29	Coke party and music, Textile Engineering Building at Craig Andersons house near domitories.
Saturay, June 30	Informal party at Craig Anderson's house near dormitories.
Sunday, July 1	Picnic and Atlanta Symphony Concert in Piedmont Park.
Wednesday, July 4	Watch Peachtree Road Race (10,000 meter run). Sports on campus - SSTP field day. Supper with Craig Anderson steaks, etc. Visit Lenox Square for concert and fireworks.
Saturday, July 7	Shopping and movies at Cumberland Mall or "Champagne Jam", rock music concert in Tech stadium.
Sunday, July 8	Open house and supper at Lundberg's home and birthday party for participants.
Saturday, July 14	*Visit Calaway Gardens - swimming, fishing, and amusements.
Sunday, July 15	Cook out supper at Textile Engineering Building; Atlanta Symphony in Piedmont Park.
Saturday, July 21	Raft race down the Chattahoochee River. Coke and music party at the School of Textile Engineering.
Sunday, July 22	Picnic supper and Atlanta Symphony in Piedmont Park.
Tuesday, July 24	*Swim at Clemson University beach. Supper at Coneross Fish Lodge.
Friday, July 27	Coke party and music, Textile Engineering Building. Visit "Wet Willie", water slide.
Saturday, July 28	Informal party in the Textile Engineering Building.

Sunday, July 29	Sightseeing in Atlanta, Barbecue supper on campus.
Tuesday, July 31	Visit Six Flags Over Georgia to study Newton's second law.
Friday, Aug 3	"Graduation", open house, and reception - School of Textile Engineering.

*Combined with educational field trips.

APPENDIX IV

"SUMMER - 79" (NSF-SSTP) - QUESTIONNAIRE

1. There were too many 11(39%), too few 3(11%), the right number 14(50%) of seminars during the program.

2. On the average seminars were too short 3(11%), too long 13(46%), the right length 12(43%).

3. The ideal length for a seminar in this program is one hour 19(68%) 1.5 hours 7(25%), two hours 2(7%), more than two hours 0 .

4. Material presented in seminars was always 2(8%), often 10(38%), seldom 13(50%), never 1(4%) difficult for me to understand.

5. The seminars which interested me most had as their subjects:

1. Psychology - 13 citations	5. Firearms - 4 citations
2. C. Anderson show - 6 citations	6. Chemical engineering & materials - 3 citations
3. Textile applications - 4 citations	7. Thermodynamics - 3 citations
4. Stress-strain behavior - 4 citations	

6. The least interesting seminars had as their subjects:

1. Chemical bonding - 7 citations	4. Textiles - 3 citations
2. Polymers - 6 citations	5. Computing - 3 citations
3. Firearms - 3 citations	

7. There were too many 0 , too few 14(52%), the right number 13(48%) of colloquia given by people from other schools on campus and people from off campus.

8. There was too much 2(7%), too little 12(43%), the right amount of 14(50%) material covered during the seven week peiod.

9. There were too many 3(12%), too few 7(26%), the right number of 16(62%) research topics from which to choose.

10. Faculty assistance on my research topic was excellent 11(41%), good 7(26%), fair 6(22%), poor 3(11%).

11. Materials and equipment to carry out my research were easy 18(67%), difficult 9(33%), to obtain.

12. More time 12(45%), less time 2(7%), the same amount of time 13(48%) should have been alloted for research.

13. What optional seminars did you attend? 1) Thermodynamics - 10 citations 2) Computer programming - 7 citations, 3) Quantum mechanics - 5 citations 4) Continuum mechanics - 4 citations, 5) Admission to Georgia Tech - 4 citations.

Did you enjoy these? Yes 18(86%), Somewhat (5%), No 2 (9%) Why? Interesting - 5 citations Informative - 5 citations

Did you learn something? Yes 17(94%), No. 1(6%)

What? 1) Some programming (FQRTRAN) - 7 citations. 2) Some understanding of thermodynamics - 6 citations. 3) Some understanding of mechanics - 5 citations.

Please comment. Thermodynamics seminars were too difficult - 3 citations Quantum mechanics seminars were too difficult - 3 citations.

14. I would have attended and participated in special, optional seminars in the following subjects:

1. English - 7 citations	4. Electronics - 3 citations
2. Mathematics - 6 citations	5. Chemistry - 3 citations
3. Biology - 4 citations	

15. More time 12(52%), less time (2(9%), the same amount of time 9(39%) should have been devoted to familiarizing me with Tech's research activities.

16. More time 13(46%) less time 2(8%), the same amount of time 13(46%) should have been devoted to familiarizing me with Tech's instructional, resource, and service facilities. Specifically: Library - 2 citations.

17. More time 8(35%), less time 2(9%), the same amount of time 13(56%) should have been devoted to familiarizing me with Tech's recreational facilities Specificially: 1. Student Athletic Center - 5 citations 2. Student Center - 4 citations

18. There were too many 1(4%), too few 15(60%), the right number of 9(36%) field trips for educational purposes.

19. The field trips for educational purposes which I enjoyed most were:

1. Duke Power Co. - 13 citations	3. Callaway Gardens - 7 citations
2. American Enka Co. - 11 citations	4. Fernbank Science Center - 7 Citations

20. The field trips for educational purposes which I enjoyed least were:

1. Fernbank Science Center - 5 citations	3. Duke Power Co. - 3 citations.
2. American Enka Co. - 4 citations	

21. There were too many 0 , too few 8(38%), the right number 13(62%) or organized outings for fun and recreation.

22. The recreation and fun outings I enjoyed most were:

1. Six Flags Over Georgia - 19 citations	5. Atlanta Symphany Concerts - 3 citations
2. Callaway Gardens - 15 citations	6. Parties in Textile Engineering Building - 3 citations
3. Chattahoochie River - 12 citations	
4. Stone Mountain Park - 4 citations	

23. The recreation and fun outings I enjoyed least were:

1. None - 3 citations
2. Stone Mountain Park - 3 citations
3. Lake Hartwell - 3 citations
4. Atlanta Symphony Concerts - 3 citations
5. Six Flags Over Georgia - 2 citations
6. Barbecues on campus - 2 citations

24. I would suggest the following outings for fun and recreation.

1. Lake Lanier - 5 citations
2. Ice skating - 5 citations
3. Atlanta Braves basefall game - 4 citations
4. Tour downtown Atlanta - 4 citations
5. Tour tops of downtown buildings - 2 citations

25. I would suggest the following field trips for educational purposes.

1. Huntsville Space Center - 3 citations
2. Communicable Disease Center-2 "
3. A textile mill - 2 citations
4. An aircraft plant - 2 citations
5. An automobile plant - 2 citations
6. Atlanta Airport - 2 citations

26. I would like to have had more free time 12(48%), less free time 0, the same amount of free time 13(52%) on week nights and weekends.

27. If I had more time, I would have used it to:

1. Do research - 8 citations
2. Rest or sleep - 7 citations
3. Participate in social activities - 7 citations
4. Participate in athletics - 5 citations
5. Recreational activities - 2 citations

28. I would recommend this program to my fellow students if:

1. It were run much the same way 13 (41%)
2. A few changes were made 15 (47%)
3. Major changes were made 4 (12%)

29. What changes should be made in this program?

1. Start seminars at 9:00 or 9:30 AM - 7 citations
2. Exercise more discipline over students - 5 citations
3. Decrease noise in dormitories - 3 citations
4. Have later curfew hours - 2 citations
5. Have seminars in morning or evening (not in afternoon) - 2 citations

30. Please comment about SUMMER - 79. Your criticism will help us to make future programs more rewarding for participants. Thank you for your help.

Great experience - 6 citations

Good experience - 4 citations

Seminars were too difficult - 3 citations